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Comparative anatomy of stomata.—From an examination of over 30 species of seed plants, taken from widely scattered genera, WARNCKE¹⁴ finds upon many very divergent forms of stomata upon the different organs. So marked is the diversity that in some instances each organ seemed to possess its own particular type. On the whole, however, stomata on stems and petioles are much alike and are usually larger and with thicker walls than those of foliage leaves. The most divergent forms are those occurring upon rhizomes and in the epidermis of the inner side of sheaths. The very different external conditions will at least partially account for the greater amount of submergence below the level of the epidermis, for the thicker cell walls of the stomata of more exposed organs, and for the tendency toward loss of function and suppression upon the submerged and subterranean parts, but it is quite inadequate to explain the occurrence of two such entirely diverse types as those found upon the outer and inner surfaces of the sheath of *Zea Mays*. As might be expected, a close relationship is found to exist between the type of stomata and the general outline of the epidermal cells.

No phylogenetic sequence is revealed in the various forms examined; indeed, the investigator does not believe that PORSCHE¹⁵ is warranted in his conclusions regarding the phylogenetic importance of the types of stomata, since he compared as homologous the stomata of various organs now found to differ to a marked degree upon the same individual, and even, in a few instances, upon different parts of the same organ.—GEO. D. FULLER.

Embryo sac of Crassulaceae.—In 1908 WENT described the ovule and embryo sac of the Podostemaceae, in which he found among other peculiarities an empty cavity or "Pseudoembryosack" extending from the base of the short sac to the chalazal region. This has led Miss ROMBACH¹⁶ to investigate the related Crassulaceae in the hope of throwing some light upon the significance of this peculiarity. Eight species were examined, which showed agreement in all essential features. A subepidermal cell of the very reduced nucellus cuts off one parietal cell and then divides to form four megasporangia, the innermost of which gives rise to an embryo sac of the ordinary eight-nucleate type. During the early development of the endosperm and embryo the base of the sac with the antipodal cells grows downward through a central strand of loose, elongated cells until it reaches the chalaza.

The author believes that here are present side by side two processes: the outgrowth of the embryo sac, and cavity formation by the nucellus. In the Podostemaceae it is supposed that the embryo sac formerly filled all the

¹⁴ WARNCKE, FREDERICK, Neue Beiträge zur Kenntnis der Spaltöffnungen. Jahrb. Wiss. Bot. **50**: 21–66. 1911.

¹⁵ PORSCHE, O., Der Spaltöffnungsapparat im Lichte der Phylogenie. Jena. 1905.

¹⁶ ROMBACH, SARA, Die Entwicklung der Samenknospe bei den Crassulaceen. Rec. Trav. Bot. Neerlandais **8**: 182–200. figs. 10. 1911.

cavity down to the chalaza, as in the Rosaceae, but for some reason, possibly as a result of the peculiar mode of life shown by these plants, the outgrowth process no longer occurs, so that the empty "Pseudoembryosack" remains. The Crassulaceae are thus regarded as transitional forms between the Podostemaceae and the Rosaceae.—LESTER W. SHARP.

Antarctic lichens.—In 1909 DARBISHIRE¹⁷ reported on the very extensive collection of lichens secured by the Norwegian polar expedition of 1898–1902 under NANSEN. In connection with this report it was shown that from the region including Arctic America, Greenland, Spitzbergen, and Iceland about 500 lichens have been recorded. A similar report has now been published by DARBISHIRE¹⁸ for the antarctic region, based upon the collection brought back by the Swedish antarctic expedition of 1901–1903. There are now known 534 lichens from the general antarctics (subantarctic America, South Georgia, and the true antarctic region), 145 of which were secured by the expedition, 34 of them being new species. The true antarctic region contains 106 known lichens. It is an interesting fact that the relation of arctic to alpine lichens is much greater than that of subantarctic American species to those of New Zealand. It is further obvious that the similarity of subantarctic to arctic species is less striking than that of antarctic to arctic species, 43 per cent of the antarctic lichens being found in the true arctics and not in temperate regions.

The new species are distributed among 17 genera, *Lecidia* and *Buellia* having 5 each; *Pertusaria*, *Aspicilia*, and *Verrucaria* having 3 each; *Bacidia*, *Lecanora*, and *Parmeliella* having 2 each. The remaining genera, each represented by one new species, are *Biatora*, *Thelotrema*, *Placodium*, *Caloplaca*, *Pannoparmelia*, *Parmelia*, *Rinodina*, *Acarospora*, and *Chaetomium*.—J. M. C.

A new Williamsonia.—SEWARD¹⁹ has studied petrified material of a *Williamsonia* from the Jurassic of Scotland, to which he gives the name *W. scotica*. It proves to be an exceedingly interesting and suggestive form. The most striking vegetative feature is the replacement of the usual scales (ramentum) of the Bennettiales by an abundance of very long hairs, such as occur on *Dioon edule* and other living cycads. The sections of the strobilus, the first obtained of a *Williamsonia*, are of special interest. The bisporangiaceous character is problematical, since no stamens were evident and NATHORST has shown that some species of *Williamsonia* were monosporangiaceous.

¹⁷ DARBISHIRE, OTTO V., Lichens collected during the second Norwegian polar expedition in 1898–1902. Publ. Soc. Arts and Sciences Kristiania. 1909.

¹⁸ ———, The lichens of the Swedish antarctic expedition. Wiss. Ergeb. Schwed. Südpolar-Exped. 1901–1903. 4: no. 11 (pp. 73). pls. 3. 1912.

¹⁹ SEWARD, A. C., A petrified *Williamsonia* from Scotland. Phil. Trans. Roy. Soc. London B 203: 101–126. pls. 9–12. 1912.